Appendix F
DOE Order 4330.4B (Maintenance Management Program) - 10 LLNL HMPTS QA Criteria Applicability Matrix

1.0 Applicability

DOE Order 4330.4B (Maintenance Management) is applicable to all Divisions and Sections. More specifically, it applies to equipment that falls into one of four categories: 1) equipment that generates hazardous or radioactive waste that must be removed from the LLNL site; 2) equipment that is part of a safety system (for example, an interlock system); 3) equipment that must be properly maintained in order to avoid serious safety problems (for example, a badly maintained crane); 4) equipment that seriously impacts the programmatic mission of the Laboratory. All real property also falls under the DOE Order.

DOE Order 4330.4B should be implemented using a graded approach. This means that the prescriptiveness and level of detail is based on the scale, cost, complexity, hazards, and programmatic significance of the work as defined by the LLNL Hazard/Assurance Prioritization System in Appendix 2. The appendix provides guidance for inter-relating the requirements of the LLNL and HMPTS QAP, Specific Quality Assurance Plans (SQAPs), and DOE Order 4330.4B (Maintenance Management Program) at LLNL's HMPTS Operations.

2.0 Maintenance Management Strategy

As stated in DOE 4330.4B , the operator is the first line of defense for the maintenance management program. Therefore LLNL's HMPTS approach to DOE 4330.4B is related to LLNL's HMPTS approach to DOE 5480.19 (Conduct of Operations) which is found in Appendix D. Operators need to be trained to recognize anomalies in equipment operation and take appropriate corrective action.

While the requirements in this appendix utilize corrective, preventive, and predictive maintenance as appropriate, LLNL's operating history shows that the most cost and performance effective maintenance strategy for systems is run to failure/run to degradation. The success of this strategy relies on the use of continuous monitoring of systems/activity performance.

3.0 Maintenance as Work Processes

The LLNL QAP is the highest-level QA/COO (Quality Assurance/Conduct of Operations) policy document at LLNL. It defines the 10 LLNL QA Criteria and the requirements for the conduct of all work activities - including maintenance activities. The HMPTS QAP is the next level for implementation of the LLNL, Laboratory wide QAP.

DOE Order 4330.4B states that the performance objectives found in the thirty-two elements are of primary importance to ensure a complete maintenance program. While DOE 4330.4B arrays the thirty-two elements under seven categories, the order states this is only an example format. As shown below, HMPTS has organized these elements under the 10 criteria of the QAP and integrated them into the base-line controls used for managing, performing, and assessing all

HMPTS Committee work. As such the elements of DOE 4330.4B should be implemented through the mechanism of the Specific Quality Assurance Plans (SQAPs), which should be viewed as the implementing documents for DOE 4330.4B. A matrix is included below.

4.0 DOE Order 4330.4B and the 10 Criteria

4.1 Program

Implementing the requirements found in HMPTS QAP Section 5.1, Criterion 1 for maintenance meets the requirements as shown on the 10 Criteria/4330.4B matrix.

4.2 Personnel Training and Qualifications

Implementing the requirements found in Criterion 2, Section 5.2 of HMPTS QAP for maintenance meets the requirements as shown in the 10 Criteria/4330.4B matrix.

4.3 Quality Improvement

Implementing the requirements found in Criterion 3, Section 5.3 of HMPTS QAP for maintenance, and implementing the more specific guidance in this section, meets the requirements as shown in the 10 Criteria/4330.4B matrix.

An equipment repair history and vendor information program should be established and maintained to provide historical information for maintenance planning and to support the maintenance and performance trending analysis of facility systems, components, and supplier manufactured items.

Surveillance, inspecting, and testing activities should provide assurance the equipment needed for safe and reliable facilities and operations performs within required limits and that preventive maintenance (PM), defined as including periodic and planned maintenance, is utilized to maintain a piece of equipment within design operating conditions and to realize its maximum reasonable useful life.

Management and maintenance organizations should have a quantitative means of measuring performance and effectiveness to improve the maintenance system.

A work-sampling program for the purpose of determining the extent of various craft activities and their related delay times should be established such that they may be used to measure the utilization of crafts in performing work in a maintenance management program.

4.4 Documents and Records

Implementing the requirements found in Criterion 4, Section 5.4 of HMPTS QAP for maintenance meets the requirements as shown in the 10 Criteria/4330.4B matrix.

A Freeze Plan is addressed in Section 4.5 (Work Processes) in this appendix.

4.5 Work Processes

Implementing the requirements found in Criterion 5, Section 5.5 of HMPTS QAP for maintenance, and implementing the more specific guidance in this section, meets the requirements as shown in the 10 Criteria/4330.4B matrix.

4.5.1 Maintenance Strategy

A measure of success of a maintenance plan is the availability of the system under maintenance for operations, and its record of safe operation for personnel and the environment. It is Laboratory policy to strive for the highest possible measure of excellence in system operation and in its safety record. The application of the requirements in this appendix should be applied as appropriate, and as it is useful, to achieve the highest levels in these measures of excellence.

Much of the maintenance effort at LLNL proceeds on a run-to-fail or run to degradation of performance basis. In these areas, the maintenance systems rely on continuous monitoring of activities. This is true for systems for which predictive maintenance work that falls in this category should be tracked through work lists, and completed work should be tracked according to the methods used to assure that the work was successfully done.

When appropriate, a formal, well-defined, work request (order) system should be in place to cover work performed, regardless of whether the jobs are repetitive or on-time tasks. The work request system should ensure that jobs are identified, logged, planned and scheduled, performed, tested, formally accepted, and documented in a "user-friendly" manner. For example, the work requests that are coordinated and processed in preparation for maintenance periods in the Equipment and Motor Pool Maintenance programs.

A system of formal job planning and estimating should be used to identify the required support, permits, hold points, work procedures, and material requests that determine the total scope of work and addresses task sequencing and steps to completion. Outage planning should promote optimum outage performance by providing integration and coordination of all work elements.

4.5.2 Work Scheduling and Priority

When appropriate, work-hours required to perform a planned job through the utilization of estimating, the application of engineered standards, the use of job slotting techniques, or other industry-recognized methods should be established to allow the determination of cost estimates, establishment of reasonable schedules, and measurement of productivity.

A systematic method of determining job priority or the importance of the work item to be performed should be established and is based on safety, environmental, and facility concerns. The priority system should be based on Appendix B (LLNL HMPTS Hazard/Assurance Prioritization System).

Scheduling and coordinating of corrective and preventive maintenance and modifications should be performed in such a way that maintenance activities are conducted in the proper sequence, efficiently, and within prescribed time limits. An outage schedule should provide for work element completion and testing and should provide management with information necessary to control outage activities.

Maintenance backlog (all outstanding corrective maintenance) should be monitored to ensure that the condition of the facility is maintained consistent with the facility's mission. Maintenance facilities, equipment, and tools should be periodically reviewed for adequacy in supporting facility maintenance training.

4.5.3 Maintenance Practices

Methods should be established to provide for the storage, issue, and maintenance of an adequate and readily available supply of tools and equipment and also for the development of special tools and equipment needed in the maintenance program.

Maintenance procedures and other work-related documents (e.g., drawings and instructions) should be used to provide appropriate work direction and to ensure that maintenance is performed safely and efficiently.

Under some circumstances, a run-to-fail mode of maintenance may be supplemented with a predictive maintenance approach, if appropriate under these circumstances, a predictive maintenance program should be established and utilized to monitor: determine trends: analyze parameters, properties, and performance characteristics or signatures of equipment in order to forecast equipment degradation so that “as-needed” planned maintenance can be performed prior to equipment failure.

Corrective (repair) maintenance should be performed in a manner ensuring that quality repairs are performed and that equipment failing or malfunctioning during service is restored in a timely manner.

Facility modification and temporary modification work should be accomplished under the same basic administrative controls as those applied to facility maintenance activities. Changes to the maintenance program to incorporate facility modifications should be commensurate with the complexity of the task, the extent of the modification, and the importance of the equipment.

Since seasonal variations in temperature and other weather conditions impact facility preservation activities, a freeze protection plan should be developed for any facility that may be at risk. A more comprehensive seasonal transition plan should provide for inspections, plant maintenance, and corrective maintenance of heating or cooling equipment prior to use and should encompass freeze protection as a part of the plan.

The above maintenance management program elements provide an environment for quality maintenance performance. To ensure that an appropriate level of performance expectation is provided to craftsmen, national consensus standards and/or field-tested workmanship standards should be established for those maintenance activities covered by these standards. Where maintenance activities are not covered by such standards and could impact safety of personnel or the continuity of facility operation, applicable maintenance procedures should be created as stated in the requirements of Criterion 4, Section 5.4 of HMPTS QAP.

Warranty/guarantee information items, components, or systems received from suppliers must be evaluated to determine whether utilization of the warranty or guarantee would be economical at a later date. If it is determined that a warranty or guarantee is of economic value, procedures should be established to "lag" future work on this item to ensure that craftsmen and supervisors do not void the agreement by accomplishment of unauthorized maintenance or repair.

4.6 Procurement

Implementing the requirements found in Criterion 7, Section 5.7 of HMPTS QAP for maintenance meets the requirements as shown in the 10 Criteria/4330.4B matrix.

4.7 Inspection and Acceptance Testing

Implementing the requirements found in Criterion 8, Section 5.8 of HMPTS QAP for maintenance, and implementing the more specific guidance in this section, meets the requirements as shown in the 10 Criteria/4330.4B matrix.

Many LLNL systems are under computer control. Maintenance of these systems should take advantage of computer monitoring of the system to signal the occurrence of incipient failure. Relevant measures of performance should be developed to determine if the system is function at an acceptable level of availability.

Periodic inspections should be carried out of equipment and facilities, assuring that proper condition, cleanliness, and housekeeping are maintained to support safe and reliable facility operations.

All real property and installed equipment should be inspected at predetermined frequencies to ensure that these facilities are maintained in a condition consistent with assigned missions or long-range planning.

Post-maintenance testing should be performed to verify that equipment, systems, and components fulfill their design function when returned to service following maintenance. The tests performed are commensurate with the maintenance work performed and the importance of the equipment to facility safety and reliability.

4.8 Management Assessment

Implementing the requirements found in Criterion 9, Section 5.9 of HMPTS QAP for maintenance, and implementing the more specific guidance in this section, meets the requirements as shown in the 10 Criteria/4330.4B matrix.

4.9 Independent Assessment

Implementing the requirements found in Criterion 10, Section 5.10 of HMPTS QAP for maintenance, and implementing the more specific guidance in this section, meets the requirements as shown in the 10 Criteria/4330.4B matrix.

DOE Order 4330.4B (Maintenance Management Program) - 10 LLNL HMPTS QA Criteria Applicability Matrix

	MAINTENANCE MANAGEMENT PROGRAM ELELMENTS	10 QA Criteria									
		1	2	3	4	5	6	7	8	9	10
3.1	**Organization, Administration & Training**										
3.1.1	Organization / Staffing	•									
3.1.2	Administration	•									
3.1.3	Policies, Goals, & Objectives	•									
3.1.4	Training & Qualifications		•								
3.2	**Condition Of Facilities & Equipment**										
3.2.1	Facility Conditions								•		
3.2.2	Condition Assessment Surveys									•	
3.3	**Maintenance Documentation**										
3.3.1	Site Maintenance Plan	•			•						
3.4	**Work Control System**										
3.4.1	Work Request / Order System					•					
3.4.2	Formal Job Planning & Estimating					•					
3.4.3	Work Performance (Time) St&ards					•					
3.4.4	Priority System					•					
3.4.5	Maintenance Procedures & Other Work-Related Documents					•					
3.4.6	Scheduling System					•					
3.4.7	Post Maintenance Testing								•		
3.4.8	Backlog Work Control					•					
3.4.9	Equipment Repair History & Vendor Information			•							
3.5	**Maintenance Faciities, Equipment & Material Control Systems**										
3.5.1	Maintenance Facilities, Equipment, & Tools					•					
3.5.2	Requisitioning / Procurement							•			
3.5.3	Materials Control					•		•			
3.5.4	Control & Calibration Of Measuring & Test Equipment					•					
3.5.5	Maintenance Tools & Equipment Control					•					

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10 QA Criteria

MAINTENANCE MANAGEMENT PROGRAM ELELMENTS		1	2	3	4	5	6	7	8	9	10
3.6	**Implementation Of Maintenance Activities**										
3.6.1	Surveillance & Preventative Maintenance			•					•		
3.6.2	Predictive Maintenance					•					
3.6.3	Corrective (Repairs) Maintenance					•					
3.6.4	Modification Work (Non Davis-Bacon)					•					
3.7	**Maintenance Evaluation & Analysis**										
3.7.1	Analysis Of Root Causes Of Problems			•							
3.7.2	Periodic Review & Analysis									•	
3.7.3	Performance Measurement & Improvement			•							
3.7.4	Management Involvement									•	
3.7.5	Work Sampling			•							
3.7.6	Cost Identification & Control	•									
3.7.7	Audits & Lessons Learned										•
4.0	**Additional Maintenance Management Requiements**										
4.1	Self-Assessment					•				•	
4.2	Seasonal Facility Preservation Requirements					•					
4.3	Maintenance Standards & Workmanship Standards					•					
4.4	WarrantyGuarantee Information					•					

LLNL HMPTS 10 Quality Assurance Criteria:

1. Program
2. Personnel Training and Qualification
3. Quality Improvement
4. Documents and Records
5. Work Processes
6. Design
7. Procurement
8. Inspection and Acceptance Testing
9. Management Assessment
10. Independent Assessment